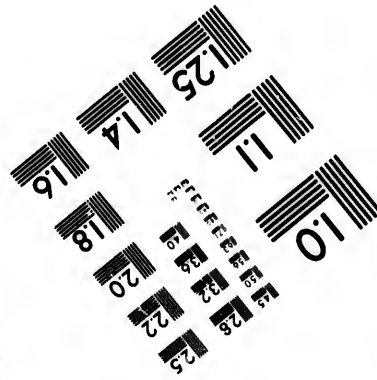
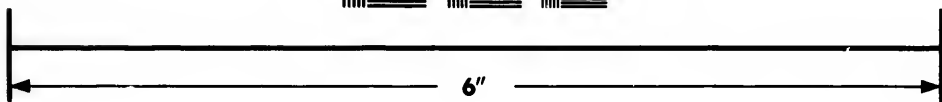
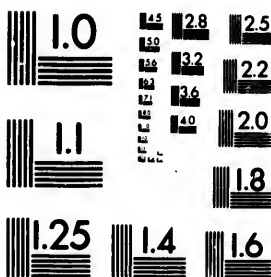


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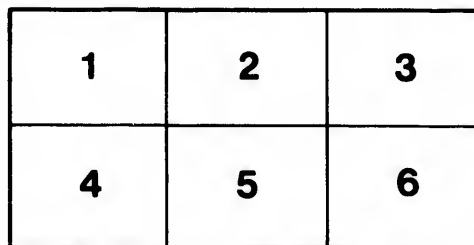
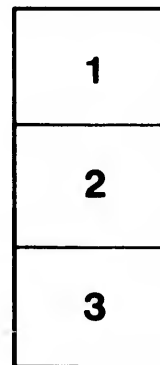
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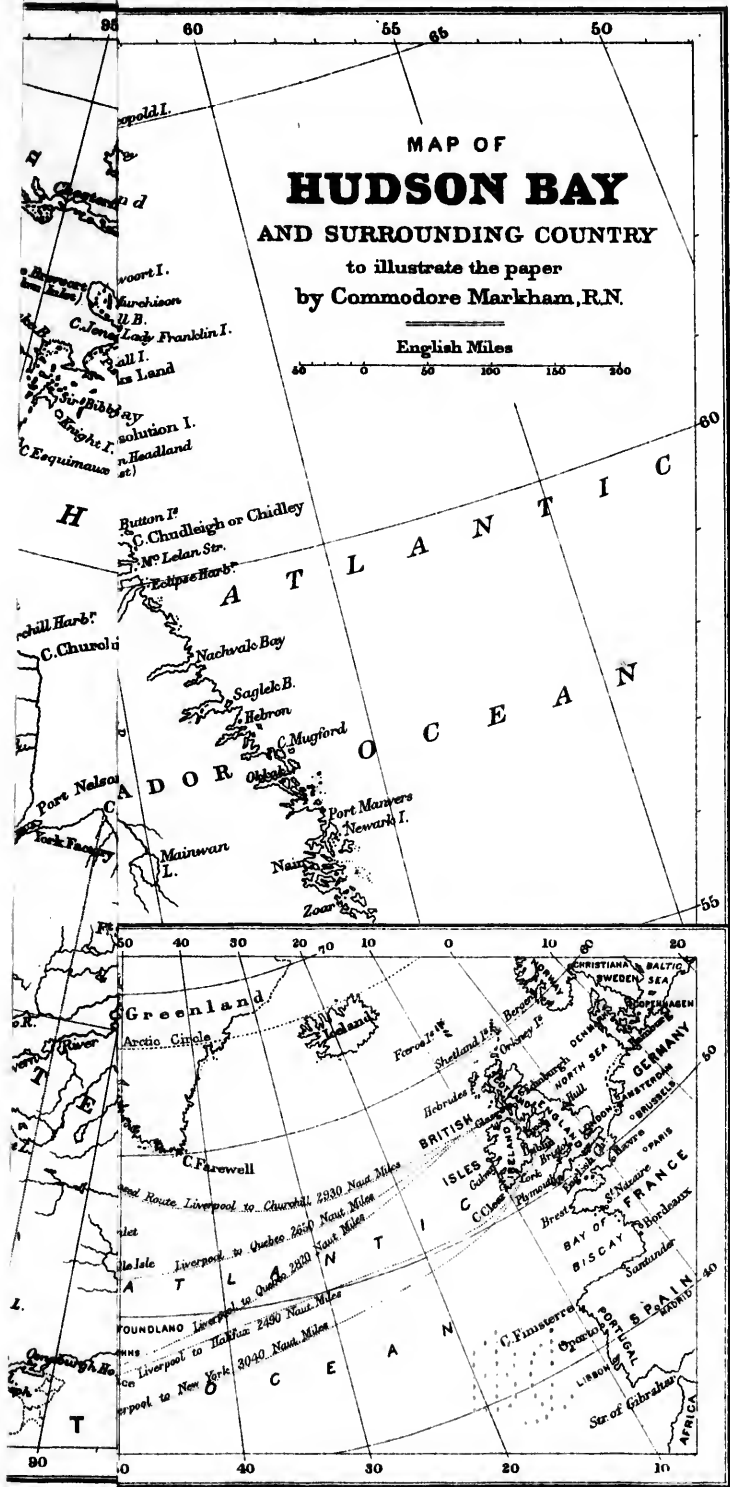


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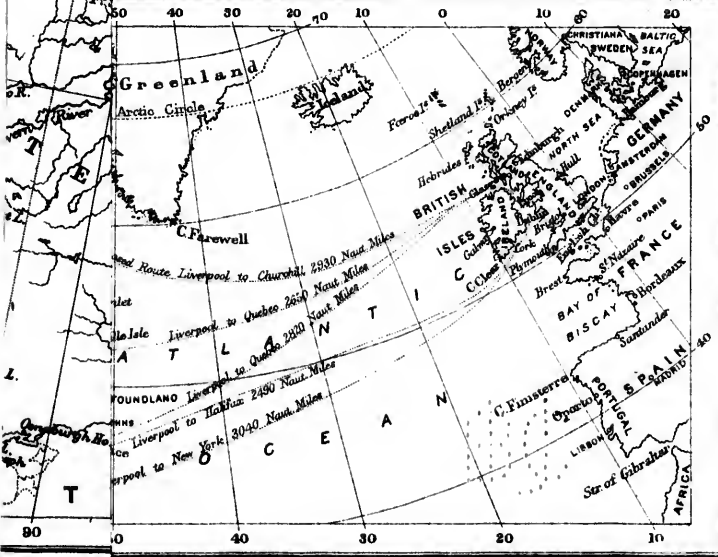




MAP OF  
**HUDSON BAY**  
 AND SURROUNDING COUNTRY

to illustrate the paper  
 by Commodore Markham, R.N.

English Miles



Wm Jno Turner, F.R.G.S., 43, Brewer Street, W.







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**PROCEEDINGS**  
**OF THE**  
**ROYAL GEOGRAPHICAL SOCIETY**  
**AND MONTHLY RECORD OF GEOGRAPHY.**

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*Hudson's Bay and Hudson's Strait as a Navigable Channel.*

By Commodore A. H. MARKHAM, R.N.

(Read at the Evening Meeting, June 11th, 1888.)

**Map, p. 612.**

THE question of the practicability of navigating Hudson's Strait in safety during a certain period of the year has lately excited much interest on both sides of the Atlantic, for reasons apart from geography. At the same time it is a question which is of considerable geographical interest, in connection with the movements of the ice in that region. The knowledge I have acquired of that part of the world is due to a careful study of the writings of our old navigators, and also of more recent reports, and this has been supplemented by the experience I gained during a voyage on board the *Alert*, through Hudson's Strait to York Factory, on the western shore of Hudson's Bay, in the summer of 1886.

I have thought that a paper containing a condensed narrative of former voyages from the time of Sebastian Cabot, and an account of my own observations, would be useful to the Fellows of this Society for reference, if published in our 'Proceedings.' I therefore prepared a monograph of this kind, which has been accepted by the Council for printing, but which would be too long for reading at one of our Evening Meetings. What I now propose to submit to the meeting is a condensed version of parts of the historical section of my paper, followed by a fuller narrative of my own experiences.

Hudson's Bay, or, as it has not been inaptly termed, the Mediterranean Sea of North America, is a large inland sea, situated between the parallels of 51° and 64° N. lat., and, therefore, well outside the Arctic zone, and between the meridians of 78° and 95° W. long. It is about 900 miles in length from north to south, and some 600 wide, covering an area of something like 500,000 square miles.

Hudson's Bay is reported to be remarkably free from rocks and shoals, and it has an average depth of about 70 fathoms. So uniform

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are the soundings, that our accomplished associate, Dr. Bell, of the Geological Survey of Canada, in a paper which he communicated to our Society in October 1881, on the commercial importance of Hudson's Bay, had no hesitation in saying that if, through any convulsion of nature, this vast basin was to be drained of its water, we should find an immense plateau similar to the prairies of the West.

I would observe that there are few authorities on this subject whose opinions should be received with greater respect than those of Dr. Bell, who has devoted many years of his life to the exploration of Hudson's Bay, and whose knowledge and experience regarding the physical geography and geology of that part of the world are so well known.

The same authority states that storms in the bay are very rare and by no means formidable, that icebergs are never seen, and that fogs, the most dreaded enemy with which a sailor has to contend, are of rare occurrence and of but short duration. The climate of the shores of Hudson's Bay, during the summer months, is mild and genial, and many European vegetables, such as potatoes, lettuce, beet-root, and onions are grown in the open air. The winters are, however, very severe.

It is asserted that the temperature of the water in Hudson's Bay is no less than 14 degrees higher than the water of Lake Superior, and in support of this assertion Lieutenant Gordon (who was sent by the Canadian Government in command of the recent expeditions despatched to Hudson's Bay for the purpose of reporting on its feasibility as a commercial route) writes, in his first official despatch, that "Hudson's Bay may, therefore, be regarded as a vast basin of comparatively warm water, the effect of which must be to ameliorate the winter climate to the south and east of it."

The principal and, so far as we know at present, the only practicable approach to Hudson's Bay in a ship is through Hudson's Strait, a deep channel about 500 miles in length, which separates Labrador from the islands of Arctic America. The strait has an average breadth of about 100 miles, but the width in the narrowest part of the channel is not more than 45 miles. The soundings in the strait vary from 150 to 300 fathoms, and it is wonderfully free from shoals and rocks, or any other obstacles that would tend to make the navigation of a narrow channel more than ordinarily dangerous.

The accounts of early voyages to Hudson's Strait are important to us, because they form cumulative evidence respecting its navigability in the months when such voyages were undertaken. John Davis, when he was returning from the extreme northern point he reached in 1587, passed across the mouth of the strait on the 1st August, and thus remarked upon it: "This inlet or gulfe we passed over: where, to our great admiration, we saw the sea falling down into the gulfe with a mighty overfal and roring, and with divers circular motions like whirle-

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pooles, in such sort as forcible streames passe thorow the arches of bridges." On the Molyneux Globe of 1593 (now the property of the Benohers of the Middle Temple, and which was lent to this Society for the Exhibition of Educational Appliances) the very words of Davis are written at the entrance of Hudson's Strait, namely "Furious Overfall."

This is one out of several proofs that Davis had a hand in the construction of that famous globe. In 1602 Captain Waymouth, during a voyage organised by the East India Company, reported that he entered an inlet in the same latitude.

Hence it was that Captain Luke Fox, who subsequently made a voyage into Hudson's Bay, recorded the very true and apposite remark that "these two—Davis and Waymouth—did, I conceive, light Hudson into his straights."

In 1610 Henry Hudson was despatched in the little *Discovery*, of 55 tons, with a crew of 21 men, to find the North-west Passage by way of the opening discovered by Davis, and marked on the Molyneux Globe as the "Furious Overfall." The labours of Hudson bore rich fruit, and he deserves a high place among our early geographers. His name is never likely to be forgotten: it is borne by the strait and by the great bay to which it leads. It is inscribed on the vast territory between that bay and the Pacific Ocean. It is affectionately remembered by the thousands of happy families now living on the banks of that beautiful river, which he found scantily inhabited by savage tribes. It was Hudson who opened to his own countrymen the fisheries of Spitzbergen and the fur trade of the Hudson's Bay Territory. The Dutch owed to him their North American colony, which afterwards became the English colony of New York. He thus built up to himself a far more enduring monument than his fondest dreams could have anticipated. His successes may well be held out as an encouragement to those who, like him, labour earnestly and steadfastly in some great cause which may seem almost hopeless.

Henry Hudson entered the strait which bears his name in the end of June 1610, and was at first much troubled by the amount of ice he encountered. For some time he experienced difficulty in making his way to the westward; and on the 11th of July, fearing the approach of a storm, he anchored under the shelter of three rocky islands to which he gave the name of "the Isles of God's Mercy." They are marked on our present charts as the "Middle Savage Islands." Thence he pushed his way westward to the Digges Islands and Cape Wolstenholme, at the entrance of Hudson's Bay, but, unfortunately, this is the last recorded incident in his journal. For an account of the remainder of the voyage we have to trust to the narrative written by one of the survivors, which, although of thrilling interest, contains little geographical information. The story of his wintering, of the mutinous conduct of the crew, and of the abandonment of Hudson and his son in an open boat, is told by this

survivor, named Habakuk Prickett. The *Discovery* returned through Hudson's Strait early in the August of 1611 without any difficulty, and the reports of the survivors led to the despatch of another expedition in the ensuing year.

Sir Thomas Button, who commanded the expedition of 1612, in the *Resolution*, proceeded through the strait in June, and reached Digges Island without much hindrance from the ice. He wintered on the west coast of Hudson's Bay, and returned through the strait in the summer of 1613 without any difficulty whatever. But, instead of emerging from the main entrance of the strait, Sir Thomas Button took his ship between the island on which Cape Chidley is situated, and the mainland of Labrador. This channel has recently been named McLelan Strait, after the Canadian Minister of Marine and Fisheries, under the impression that it is a new discovery. *Resolution* Island is the name of the island on the north side of the entrance to Hudson's Strait. If the island on the south side, on which Cape Chidley is situated, was called *Discovery* Island, we should then have the two portals of the strait named after the two first ships that ever passed a winter in Hudson's Bay.

The enterprising company of merchant adventurers was not discouraged by the failures of Hudson and Button. In 1615 they again despatched the little *Discovery*, under the command of Robert Bylot, with that accomplished navigator, William Baffin, as pilot. During this voyage, Hudson's Strait was entered towards the end of May, and on the 8th of June the Savage Islands were reached and named. Proceeding westward along the northern shore, the *Discovery* stopped at a place called Broken Point. The spot is memorable because here the first lunar observation ever observed by an Englishman, for finding the longitude, was taken by William Baffin. This admirable pilot drew a most interesting chart, on which the coast-line and prominent headlands and islands are delineated, with a fair approach to accuracy. There were some delays in passing through the strait, owing to loose ice, but they were clear of it by the 1st of July. On her return in August the *Discovery* passed through the strait without encountering any obstacle whatever. But the great mistake made by Baffin, and indeed by all the old Arctic navigators, was that they relinquished exploration too early in the season.

In 1619 Captain Hawkrige sailed through the strait; and in the same year a Danish expedition under Munk also entered the bay, neither commander encountering any serious obstacle. Twelve years afterwards two vessels were fitted out, one at London, the other at Bristol, under the commands of Captain Luke Fox and James respectively, which entered Hudson's Bay.

Captain Fox was a quaint and witty writer, as well as a bold seaman. His description of the ice he met with in Hudson's Strait is so good, and so exactly coincides with my own experience of the ice in that locality,

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that it will be well to quote it. He says: "The ice in the strait consists of two kinds, one of which is mountainous (a huge piece, compact, of great quantity, some more some less), but in this fret" (as he calls the strait) "you seldom have any bigger than a great church, and most thereof lesse." This description of course has reference to the icebergs met with at the entrance and in the eastern part of Hudson's Strait. He then describes the floe or pack ice as follows:—"The other kind is smaller, and is what we call masht or fleacht ice. Of this you shall there have numbers infinite, some of the quantity of a roode, some a perch, some an acre or two acres. But the most is small and about a foot or two above water, and eight or ten under water, and these are they which do enclose you; so as in much wind, from the topmast head, you shall hardly see any water for them. But while you lie amongst them it is so smooth as you shall not feel the ship stirre." It would not be possible to give a more accurate account of the conditions of the ice in Hudson's Strait at the present day, than is furnished by this description written by Captain Luke Fox more than 250 years ago. It exactly describes the peculiar nature of the ice that is usually met with during the navigable season in this channel, and which I have not observed in any other part of the northern regions. Fox found little difficulty in passing through the strait, and was in Hudson's Bay by the 21st of July. His return voyage, during October, was still more easy, for he encountered no obstacle whatever, and was off Resolution Island on the 31st of October. Captain James, whose voyage was undertaken in the same year, 1631, reached the entrance of Hudson's Strait on the 24th of June, but was delayed in consequence of striking on a rock, and did not complete the passage of the strait until the middle of July. James wintered in the southern extremity of Hudson's Bay, and in 1632 he again passed through the strait, on his way home, without any difficulty whatever.

No further attempt was made to visit these seas, until a charter was granted to Prince Rupert and some enterprising merchants in 1669, and the Hudson's Bay Company was founded. Captain Gillam, in the *Non-such*, was then sent out. He passed through Hudson's Strait without difficulty, and established a settlement near James's winter quarters, which he called Fort Charles. He returned the following year.

From this date, for a period of fifty years, no interest appears to have been taken in geographical research in the Hudson's Bay region; although the Company's ships were frequently engaged in making the voyage from and to England. But at last two ships were fitted out by the Hudson's Bay Company for purposes of discovery, commanded by Captains Barlow and Vaughan; they were accompanied by Mr. Knight, an official of the Hudson's Bay Company who had suggested the voyage, and who was nearly 80 years of age. They sailed from Gravesend in 1719, but three years elapsed without any tidings of them being received.



A ship called the *Whalebone* was sent from Churchill in search of them, under the command of Captain John Scroggs, in June 1722, but without result. It was not until the year 1767 that the melancholy fate of the missing ships was ascertained by some of the Company's boats engaged in the whale fishery. The ships had been wrecked on Marble Island, and the crews had perished after reaching the shore.

The next important expedition was that commanded by Captain Middleton, which left England in 1741; and this was followed by another, under Captain Moor, in 1746. Middleton passed through Hudson's Strait without difficulty, and although Moor was baffled by pack ice for several days, he succeeded in making the passage early in the season. Mr. Wales, who was sent out by the Royal Society in 1768, also passed the strait with ease. In fact he was only nine days in going through, during which time he met with no ice to interfere with the progress of his ship, although he was delayed by contrary winds and calms.

During the whole of the eighteenth century vessels belonging to the Hudson's Bay Company made annual voyages to, and from, England to York and Moose Factories. They very rarely failed to make the voyage, and few of the ships were lost. One of the masters in the Company's service, Captain Coats, who had been many years employed in navigating those seas, wrote a practical and very interesting treatise in 1750, which he named 'The Geography of Hudson's Bay.' It has been printed for the Hakluyt Society, and was edited by our associate, Mr. John Barrow.

An expedition of discovery, sent out at the instance of the Hudson's Bay Company in 1791, under Captain Duncan, forms an exception as regards the easy navigation of the strait. The vessel encountered much ice, which so delayed her that it was not until the 5th of September that Captain Duncan reached Fort Churchill.

We now come to the expeditions of Sir Edward Parry in 1821-23, of Captain Lyon in 1824, and of Sir George Back in 1836. The events of these memorable voyages are well known, and are indeed matters of history. Parry encountered much ice at the entrance of Hudson's Strait on the outward voyage, and nearly the whole month of July was occupied in getting through it. But the delay was occasioned as much by adverse winds and calms, as by the ice. On July 21st Parry wrote: "Bodies of ice became less and less numerous as we advanced up the strait from Resolution Island, and no ice was seen after we had proceeded a few leagues beyond the Upper Savage Islands." On the 25th he reported "the sea almost free from ice"; and on the 27th and 28th "ice in great quantities, but the pieces so loose as easily to allow the passage of a ship with a free wind. This ice was so honeycombed, and rotten, that it appeared in a fair way of being entirely dissolved in the course of a few weeks." This was, in all probability, ice that had drifted down

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through Fox's Channel. The weather was on the whole fine and clear, only four foggy days being recorded during the month of July.

During the return voyage, in September 1823, Parry was only five days passing through the strait, during which time no ice whatever was to be seen.

Regarding the best time for navigating the strait, Sir Edward Parry says: "Long experience has brought those who frequent this navigation to the conclusion that, in most seasons, no advantage is to be gained by attempting to enter Hudson's Strait earlier than the first week in July. The annual disruption of the ice, which occupies the upper and middle parts of the strait, is supposed not to take place till about this time. In the course of one single year's experience in these parts, we have seen nothing to recommend a practice different from that at present pursued by the ships of the Hudson's Bay Company."

I heartily concur with every word in this quotation, for it exactly corresponds with my own experience. But the fact must not be overlooked, that this advice is addressed to those who attempt the navigation of the strait in sailing ships. Steam has made a great revolution in ice navigation. A well-found steamer is able to make her way with ease through the ice in Hudson's Strait in June and July, when a sailing ship would be hopelessly beset, and incapable of pushing on. With regard to the practice pursued by the ships of the Hudson's Bay Company, alluded to by Sir Edward Parry, it stands to reason that the captains of those ships would naturally delay their passage across the Atlantic, so as not to reach the strait before July or August; for they were well aware that every extra day spent on the passage was a day nearer the disruption of the ice. Their experience told them that a policy of waiting was the wisest, when the chances would be more in their favour of getting through without hindrance from the ice.

In 1824 Captain Lyon, in the *Griper*, passed through the strait in fourteen days, namely from the 6th to the 20th of August. He sighted some loose heavy ice off Resolution Island, but otherwise experienced no difficulty in getting through. On his homeward voyage no ice whatever was seen in the strait, and he averaged, in his dull old bluff-bowed sailing ship, 150 knots a day, as he passed through, from Cape Wolstenholme to Resolution Island.

During Sir George Back's memorable and eventful voyage in the *Terror* in 1836, he encountered much ice in the strait. But this appears to have been an exceptionally bad ice year. Still he was not more than a fortnight in getting through, namely from the 1st of August, when he was off Resolution Island, to the 14th, when he passed Nottingham Island. His course was then directed up Fox Channel, where his ship was closely beset by heavy ice, in which, helplessly drifting at the mercy of the winds and currents, he was compelled to pass the winter. During

a period of six months the ship drifted 234 miles in a generally south-east direction.

It is almost impossible for us to conceive, much less to describe, the anxiety that must have been experienced on board the *Terror* during those long dark months, when officers and crew were, it may truly be said, momentarily expecting the destruction of their floating home. She was most miraculously preserved, in spite of the terrible injuries inflicted on her by the ice, and she succeeded in making one of the most marvellous voyages on record across the Atlantic. The objects of Sir George Back's voyage were unfortunately frustrated by the ice in Frozen Strait. But although the amount of geographical information obtained was not very great, yet the voyage was exceedingly instructive, as showing the general drift of the ice down Fox Channel and Hudson's Strait.

The account of the *Terror's* voyage home embraces one of the most thrilling stories of sea adventure that has ever delighted the readers of this country. When all hope of saving the ship and the lives of the crew had almost died out in the breast of the captain, the coast of Ireland was sighted; Captain Back then succeeded in running the *Terror* on shore off Buncrana, in Lough Swilly. The men were harassed and nearly worn out by their exertions in keeping the ship afloat; and the vessel herself, leaking like a sieve from the injuries she had received in the ice, was only held together by the stream cable being passed round the after part, and so binding her timbers and planking.

This was the last Government expedition, having geographical research solely for its object, that entered Hudson's Bay. But its waters have been navigated by the ships of the Hudson's Bay Company year after year. These vessels were annually despatched from England for York and Moose Factories, sometimes two, and even three being sent in a year. They rarely failed to reach their destinations, for, arranging as they usually did to reach Hudson's Strait, on their outward voyage, in about the first week of August, they experienced but little difficulty from the ice. On their return voyages in September and October, they always found the strait comparatively clear.

I have in my possession an official record of the voyages, out and home, of the Hudson's Bay Company's ship *Prince Rupert* for a period of eleven consecutive years, namely, from 1835 to 1846 inclusive. I find that the average time of getting through the strait, on the outward voyages during this period (and it must not be forgotten that the strait is 500 miles in length), was 16 days. The longest time was 31 days, when there was probably an exceptionally bad ice year. The shortest time was eight days. But the delays in getting through the strait were invariably caused by calms and adverse winds, and not by the ice. On the homeward passages no difficulties were met with from ice in the

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strait, and the vessel usually reached London in about five weeks after leaving York factory. The earliest date for sailing from York factory was the 6th of September, and the latest the 3rd of October. In the latter case the *Prince Rupert* was 38 days on the passage to London; so that it is impossible she could have had any serious detention from ice in the strait.

It must be remembered that this vessel, and all others then employed by the Hudson Bay Company, were sailing ships, dependent entirely on sails for their motive power. Without wind they were helpless; with a foul wind their progress was of course proportionately slow. Wind, therefore, was a matter of the first importance in those days, when a vessel was endeavouring to make way through floes of loose ice; for when the wind falls, the ice invariably loosens, or, as the technical expression is, "goes aboard." But, under such circumstances, the unfortunate sailing vessel, being deprived of its only propelling force, is unable to take advantage of the ice being loose to push on. On the other hand, when a breeze springs up, which on ordinary occasions would possibly enable her to make good way, the wind has the effect of packing the ice, thus rendering progress nearly impossible.

Steam has now, however, effected a complete revolution in ice navigation, and the most advantageous time for pushing on is, of course, in calm weather, when the ice is loose. Under similar conditions a sailing vessel would be utterly hopeless. It is, therefore, only reasonable to infer that what has been performed regularly, and year after year, by sailing ships, can be accomplished with greater regularity and certainty by well-found steamers, specially constructed for ice navigation, and provided with powerful machinery. A channel which has been navigated for 270 years, first by the frail little fly-boats of the seventeenth century, then by the bluff-bowed, slow-sailing, exploring vessels of Parry's days, and for a long period by the Hudson's Bay Company's ships, cannot be very formidable, and if sailing ships can annually pass through it, *à fortiori* steamers will find less difficulty in doing so. But it would, of course, be necessary that such steamers should be specially built and equipped for the service, and it is desirable that despatch should be used in making the voyage.

The nature and consistency of the ice in Hudson's Strait are such that, with an efficient steamer, the passage could be accomplished with very little delay or difficulty. This being the case, it is not surprising to hear that the people of the North-West are anxious to have a sea-port on the shores of Hudson's Bay, and to secure the construction of a railroad to connect such a port with Winnipeg, or some other equally convenient dépôt on the newly established line of the Canada and Pacific railroad.

The achievement of such an undertaking would result in shortening the distance that the produce of the country, destined for exportation,

would have to be transported by one-half. As the cost of transport by rail is governed by the distance to be conveyed per mile, it will at once be understood that if the mileage is reduced by one-half, the cost of conveyance will be diminished in the same proportion. It has been estimated that the result of the construction of a railroad from Winnipeg to Hudson's Bay, would be a clear gain to the farmers and producers of the North-West, of about 3*l.* per head on all cattle exported, and 5*s.* upon every quarter of grain sent for shipment.

The only obstacle to the establishment of the desired port, and to the opening of this route, is the belief in the formidable character of the ice that, we are told, would have to be encountered in Hudson's Strait, and the consequent limited duration of the navigable season.

There has been great controversy on this question. The advocates of the route maintain that the ice offers no obstacle which may not be overcome. Monopolists, and persons interested in other routes, represent the difficulties offered by the ice in Hudson's Strait as fatal to the success of the project. The question is a purely geographical one, its solution depends on physical considerations, and the controversy is therefore a clear gain to the science of geography.

In order to obtain full and accurate information on the questions involved in the discussion, the Government of Canada, with commendable energy and a praiseworthy determination to solve the long-disputed problem as to the practicability of navigating the strait annually, came to the resolution of despatching a vessel for the purpose of establishing stations on both sides of Hudson's Strait, at which continuous daily observations could be taken and recorded on the weather, tide, temperature, condition and movements of the ice, and other facts connected with the meteorology of that region, for a period of at least twelve consecutive months. A steamer called the *Neptune*, which had been built for and employed in the sealing trade, was chartered and despatched in the year 1884 to perform this service.

The *Neptune* was in every way admirably adapted for the work she was required to perform, having been specially constructed for ice navigation. Her voyage was eminently successful. She experienced little difficulty in passing through Hudson's Strait, and succeeded in establishing stations at the following places. One, named Port Burwell, near Ungava Bay on the south side of the Strait, close to the entrance. Another in the vicinity of the Upper Savage Islands, at Ashe Inlet. Another was immediately opposite, on the south side of the strait (Stupart Bay). The fourth station was on Nottingham Island, and the fifth was established on Digges Island, at the opening into Hudson's Bay. An observer, with a couple of attendants, was placed in charge of each of these stations, with a supply of provisions to last over twelve months.

In the official report of the voyage of the *Neptune* whilst engaged on this service, her commander states that had he been making the passage

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direct to Churchill, instead of coasting and visiting specially selected places on both sides of the strait, he would not have been delayed by ice for more than about forty-eight hours. On the homeward voyage down the Strait there was no check whatever, no ice having been encountered. The *Neptune* can, I believe, fairly lay claim to the honour of having been the first steam vessel that has ever crossed the waters of Hudson's Bay.

On the return of the *Neptune* to Halifax, steps were immediately taken to secure the despatch of a vessel to Hudson's Strait in the following year, for the purpose of visiting and relieving the stations established there.

In order to assist the Canadian Government in their praiseworthy endeavours to obtain reliable and accurate information regarding the navigation of the Strait, the English Government placed H.M.S. *Alert*, (a vessel which had already gained for herself a reputation in Arctic research) at their disposal. She was officered and manned by the Canadian Government, sailed from Halifax, and reached the entrance to Hudson's Strait on the 16th of June, 1885. But through some mismanagement, or want of experience in ice navigation on the part of those who were occasionally entrusted with the charge of the ship, she was allowed to be beset by the ice. No advantage appears to have been taken of her steam power to extricate her. In fact, the reverse seems to have been the case, for in the official report of this voyage we read that, instead of utilising the power that was at their disposal to release her from her imprisonment, they "banked the fires and left the ship to pull under a fore-topsail and fore-topmast staysail."

The "pull," however, does not appear to have been in the desired direction, or, if so, it was misapplied, for we learn that shortly afterwards the stem of the ship was so seriously injured by coming into contact with the ice, that it was considered not only desirable but necessary to return to the southward, and they put into St. John's (Newfoundland) in order to effect the necessary repairs. The repairs were, however, easily and speedily executed, and by the first week in August the *Alert* was again in Hudson's Strait. The next few days were employed in visiting the stations established during the previous year, which was done without much difficulty, and on the 31st of the same month the *Alert* reached Port Churchill, having spent a few days at each station. When her duties were completed she sailed for Halifax, meeting no ice whatever during the return journey, although it was the 7th of October before she was clear of the Strait.

The reports obtained from different stations regarding the presence and conditions of the ice in the Strait, supplemented as they were by those received from the *Neptune* and *Alert*, were on the whole decidedly satisfactory, in so far as they bore on the question of the safe navigation of Hudson's Strait during a certain period of the year.

In the following year, namely 1886, it was again resolved to despatch

the *Alert* to Hudson's Bay. But this time it was with the object of dismantling the stations in the Strait, and taking the observers back to Halifax. It was considered that the duty on which they were employed had been accomplished.

By a fortunate accident I was able to avail myself of an invitation I had received, to take a passage in the *Alert* during this cruise.

I considered myself very fortunate in having the opportunity afforded me of doing so, for it had long been my wish to visit Hudson's Bay, and I had almost decided upon accomplishing this object by travelling from Winnipeg by canoe. The offer, therefore, of going in the *Alert*, which would enable me to make the passage of the strait, as well as of the bay, was too good to be refused, and I eagerly availed myself of it. I was thus enabled to form my own judgment of the state and conditions of the ice in Hudson's Strait during at least one season of the year; while my observations, combined with a comprehensive study of all that has been written on the subject, would enable me to form my own views regarding the practicability of the route as a commercial highway. I was also able to form a better estimate relative to the duration of the navigable season.

I might observe that I was quite ignorant of the controversy that had been carried on for some time between those who were in favour of Hudson's Strait as a commercial route and those who were opposed to it. I was, therefore, in a better position to form a perfectly impartial and unbiassed opinion.

Under these circumstances I joined the *Alert* at Halifax, and sailed in her from that port on the 23rd of June.

On the 5th of July we reached the entrance of Hudson's Strait, where we were detained for some days, partly by thick weather and partly by loose streams of ice; but the latter were never packed sufficiently close to prevent even a slow steamer like the *Alert* from making fairly good progress. The ice that we encountered was of a soft brashy consistency, the greater part of it being honeycombed from the action of the water, and in an advanced stage of disintegration. Whilst thus delayed at the entrance of the strait, we observed the same remarkable commotion of the water that had been commented on by Davis, Parry, Back, and other navigators. Davis called it, on the globe of 1593, the "Furious Overfall." It is not easy to account for these turbulent eddyings and overfalls. We frequently observed comparatively large pieces of ice being swept, with great velocity, in opposite directions, although they were close to each other. The ice, on these occasions, was evidently very much influenced by local forces, such as tides. So far as we were able to discover, the flood—or west-going tide—caused the ice to slacken, whilst a contrary effect appeared to be exercised on it by the ebb. From the 9th to the 11th of July scarcely any ice was seen, and a distance of over 200 miles was accomplished in about thirty-six hours. This fact alone, without further

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evidence, is in itself sufficient to show how free the eastern part of the strait was from ice; for the *Alert*, if driven at her full speed, could only steam about six knots an hour.

Early on the morning of the 11th of July we arrived off the station on the north side of the strait, and anchored in a snug little bay called Ashe Inlet. The observers were found to be in perfect health, and they had spent a pleasant winter, having been well supplied with reindeer meat by the Eskimos. They informed us that the ice did not form in the strait before December, and that the channel was perfectly free for navigation during the entire month of November. Game appeared to be plentiful in the neighbourhood of the station. Numerous herds of reindeer were met with during the winter, and hares were reported as abundant on an adjacent island; whilst bears, seals, and walrus were frequently seen.

After leaving Ashe Inlet the *Alert* continued her passage through the strait, but her progress was so retarded by ice, that it took her nine days to accomplish a distance of 300 miles. This slow progress was mainly caused by the absence of sufficient steam power to enable her to thread her way through the loose ice, and also by a want of vigilance in taking advantage of the various movements of the ice. A knowledge of ice navigation, like everything else, cannot be acquired at once. Practical experience, unceasing vigilance, and a happy knack of doing the right thing at the right moment, are essential qualifications for those seamen who desire to become successful ice navigators.

The ice that we encountered in the western part of the strait was somewhat different, and heavier than the ice we passed at the eastern entrance. It was composed of small pieces, packed loosely, appearing as if the floes had been broken up and then drifted together. This peculiar feature of the ice in Hudson's Strait is one that I never observed in other northern seas, and it is worthy of consideration when the question of the practicability of navigating the strait is under examination. For it is these innumerable small pieces that, in a great measure, deprive the pack of the force necessary for the serious injury of any vessel that is beset in it. When there is a nip, the small pieces, being composed of soft brashy ice, act as a cushion between the ship and the larger floes, thus protecting her from violent pressure.

The greater part of the ice was, in my opinion, formed in Fox Channel, whence it drifts down to the strait after the disruption of the ice in the summer. Occasionally a few large floes were seen, some of which I estimated to be about half a mile in length, but a floe of this size was quite exceptional. The average thickness of the floe ice was 9 feet, but it was all more or less rotten, and rapidly dissolving.

A circumstance worthy of note in connection with the heavier and larger floes that we met with, was the irregularity and unevenness of their surfaces. A perfectly level floe of any extent, having a flat



surface, was rarely seen. They were usually crowned with a succession of excrescences resembling small hillocks. This gave me the impression that the floes were composed of many small pieces of ice which, having survived the preceding summer's thaw, had been cemented together into one large mass by the snow and frost of the succeeding winter. Many of these floes were discoloured by dirt and débris, and on a few of them I noticed thick mud adhering, showing that they were formed in the immediate vicinity of land. The heavier ice we encountered, had probably drifted down from Fox Channel, where large thick floes are known to exist.

No icebergs were seen to the westward of the Savage Islands, which seems to show that all those we passed to the eastward and at the entrance of the strait, had floated down from Davis Strait, or at any rate were the produce of glaciers north of Resolution Island. During the time that we were in the strait the weather was generally fine, the average temperature being about 35° Fahr., although on some days the thermometer would rise to 50°. The prevailing wind was from the westward, but from whatever direction it blew, it appeared to have but little effect on the movements of the ice. When we have more accurate information regarding the tides in Hudson's Strait, further light will in all probability be thrown on the movements of the ice.

After being in the ice for upwards of eight days, the *Alert* arrived at Digges Island (where one of the observatories had been established) on the 20th July. This island, which forms a leading feature in the story of Hudson's voyage, consists of bare hills of gneiss, rising to a height of about 500 feet. The hills are intersected by broad valleys, carpeted with moss and coarse grass. The vegetation compares very unfavourably with that of some of the small islands on which I have landed off Novaya Zemlya, and which are in a much higher latitude. On the coasts of the latter the southern current warms the air and produces a comparatively luxuriant flora, while the former is exposed to cold Arctic streams.

After leaving Digges Island the open water of Hudson's Bay was reached, and from that time, with the exception of passing through a few loose streams of broken-up stuff, no ice was seen. The *Alert* dropped anchor in Churchill Harbour on the 29th of July, without encountering any further difficulties from the enemy with which she had been contending for ten days. From Churchill we proceeded to York Factory, where I left the ship, proceeding on to Winnipeg by canoe.

On her return passage through Hudson Strait, the *Alert* revisited the different stations without experiencing any difficulties from the ice, and having embarked the observers and their attendants, she returned to Halifax.

The result of all the experience, gathered from voyages during two centuries, and from more recent observations at the stations, is that

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Hudson's Strait is perfectly navigable and free from ice in August, and later in the season. It must be remembered that this passage has been successfully accomplished nearly every year for the last two centuries, while the vessels that have been employed on the service have been ordinary sailing ships, dependent entirely on wind and weather. It is very rare indeed that they have failed to get through, and still more rare that any of them have been destroyed by the ice. It appears from the official records of the Hudson's Bay Company that Moose Factory, on the southern shore of the bay, has been visited annually by a ship since 1735, with but one exception, namely in 1779, when the vessel for once failed to achieve the passage of the strait. The percentage of losses by shipwreck among these vessels employed in Hudson's Bay is far less than would have to be recorded in a like number of ships engaged in general ocean traffic. Since the keel of Hudson's good ship the *Discovery* ploughed the waters of the strait, the passage has been made over 500 times, whilst the losses due to the ice might be summed up on the fingers of one hand; and some of these losses were due to causes with which the ice had nothing to do. For instance, the recent loss of the *Cam Owen* was in no way connected with the ice.

In conclusion, after reviewing the physical aspects of the region, and the record of voyages, we must again call to mind the fact that the vessels employed on Hudson's Bay service have hitherto been sailing ships. Steam has now robbed ice navigation of many of its difficulties and dangers, and it is only fair for us to assume that, with the appliances that science has since revealed to us, we can, in these days, achieve with greater ease and celerity, and with more assured certainty, as much as was accomplished by Hudson and Baffin, by Button and Luke Fox, in their rude and poorly equipped fly-boats.

The vessel, however, to be employed on such a service, should be specially constructed to resist ordinary ice pressure, and should be provided with power to be able to steam from 10 to 12 knots at least. We in the *Alert* were frequently detained for many consecutive hours at a time, for want of power to propel the ship through loose streams of ice, which an ordinary steamer would have had no difficulty in penetrating. It is necessary that all vessels employed in ice navigation should be strengthened, especially in the bows, not so much for the purpose of resisting the pressure of the ice, if beset, as to repel the severe blows which must occasionally be inflicted by unavoidably striking unusually heavy pieces, whilst threading their way through a stream of ice.

The case then can be very briefly stated. If sailing ships have annually taken the furs, and other merchandise, of the Hudson's Bay Company through the Strait for the last two centuries, *à fortiori* it may be looked upon as certain that powerful steamers will be able to do the same for the produce brought to the west coast of Hudson's Bay by a railway from Winnipeg.

The establishment of new routes for commerce is always a gain to the science of geography. In some cases new regions have to be discovered and explored. In others the physical aspects of an already known region must be more carefully studied, and many points of interest relating to the action of climate, or of winds and currents, may be ascertained. The proposed Winnipeg and Hudson's Bay railroad is a striking instance. The objections of opponents to the route have had to be carefully examined. All former experience had to be collected, maturely considered, and passed in review. Observatories had to be established at several points, to make certain whether the historical records actually coincided with physical facts as they now exist. The route itself had to be sailed over and explored. All these various researches have been as great a gain to geography as to commerce. They have enriched our science with a fresh stock of information, have revised previous conceptions, and confirmed or rejected, as the case may be, the theories and views which may have been put forward. From this point of view, and from this point of view alone, can commercial or political questions receive consideration here. The study of the Hudson's Bay route involves a problem for which physical geography alone can furnish a solution; and on those legitimate grounds I have ventured to submit it for the consideration of the meeting. My labours will be more than rewarded if I have succeeded in my endeavour to give a new point of interest to a region which, though already well known, is exceedingly interesting, and is on the direct road to unknown parts of the earth.

The following discussion ensued:—

Sir CHARLES TUPPER said he had listened to the paper with unqualified pleasure. It was impossible to look at the map of North America without seeing how vitally important every question became that had a bearing upon the increase of facilities for intercourse between Canada and the British Islands. The American Consul, Mr. Taylor, who has lived for more than twenty years at Winnipeg, whose knowledge of the country is not exceeded by that of any other person in it, and who might be assumed to speak in an entirely disinterested manner, had stated that of the remaining undeveloped wheat-fields in North America, three-fourths were to the north of the boundary-line. During the last season 16,000,000 bushels of grain were produced in Manitoba and the North-west Territory. It was therefore manifest that it was of the utmost importance to obtain the nearest and best route for disposing of the produce. The chief outlet from that great granary was at present by means of the Canadian Pacific Railway, which ran from Vancouver down to Montreal and Quebec, from whence the grain was taken by ocean steamers to England; but another outlet was by the great inland navigation from the head of Lake Superior to the Straits of Belle Isle. A line of communication via Hudson Bay would bring Winnipeg, the capital of Manitoba, 1100 miles nearer to this country than by the route via New York. That fact gave immense importance to the investigations which had been made in connection with the navigability of Hudson Bay. It was perfectly apparent that if the territory were only half developed it would tax beyond their capacity all the resources of the Canadian Pacific Company, and also the resources of an additional line of railway to Churchill. The Canadian Pacific

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Company, which owned 14,000,000 acres of this great wheat-field, would be only too glad to see additional facilities afforded between that region and Europe. Under these circumstances, it was very gratifying to learn that Commodore Markham was able to add his personal testimony to the experience of those who had endeavoured to open up that country, and to give so many reasons for entertaining the belief that it might be found practicable to establish a comparatively safe route for the trade for several months of the year. It was true that the officers sent there by the Canadian Government had not taken so sanguine a view, but Commodore Markham was a higher authority than any one who had been employed there by the Government. If it could be demonstrated that for four or five months in the year a fairly safe communication could be established by that line, he had no hesitation in saying that the day was not far distant when a railway would be made from Winnipeg to Fort Churchill. The Government of Canada had not only sent various expeditions to Hudson Bay for the purpose of testing its navigability, but they had obtained from the Canadian Parliament 7,000,000 acres of land for subsidising and constructing a line of railway 700 miles long from Winnipeg to Fort Churchill.

Dr. RÆ said he had made three voyages through Hudson's Strait in sailing vessels. On the outward voyage, in the month of July, the ship was closely beset in very heavy ice at the east end of the strait, near the Lower Savage Islands, for three weeks, there being little or no open water to be seen from the masthead for nearly the whole of that time. The pack was of such large and level floes that two English ladies, not accustomed to such work, frequently walked without difficulty from one ship to the other—1½ miles apart—took lunch, and returned the same day. It was similar ice to this that blocked up the *Alert* for about twenty days near the same locality in 1885, and it was near the same place in May and June 1886 that the whaling steamer *Arctic*, of Dundee, the finest vessel in the world for ice navigation, was helplessly drifted about for eight or nine days in the ice-pack until released in the strait near the Savage Islands, from which place it took this powerful vessel *thirty-eight days* to reach the western end of the strait at King's Cape, a distance of about 500 miles, on the 10th July, having steamed along the north shore, which is often the freest from ice. The floes met with were from 15 to 20 feet thick. He (Dr. Ræ) brought forward the voyage of the *Arctic*, commanded by an able and experienced whaling captain, because Commodore Markham had stated that the difficulties met with by Lieutenant Gordon in passing through the strait were to be accounted for by mismanagement or want of experience in ice navigation, and to the defective steam power of the *Alert*, "*which could steam only six knots an hour.*" Lieutenant Gordon several times records in his log or journal that the *Alert* could and did steam at the rate of eight knots. It is very evident that this, according to Markham, slow little vessel and incompetent commander made quite as good progress through the ice in the strait as the larger and far more powerful steamer *Arctic*, and her well-known experienced commander in icy seas. The writer of the paper quotes Dr. Bell as a distinguished and reliable authority in all matters relating to Hudson's Bay and Strait. He (Dr. Ræ) knew no one on whom he could place less reliance on these subjects, but he would only give two reasons, of many, why he entertained this opinion. Dr. Bell, wishing to make it appear that the shores of Hudson's Bay are well fitted for settlement, caused some tomatoes to be planted in a well-sheltered corner, on the south exposure of the wooden walls of Moose Fort, and had the plants carefully nursed and attended to, so that one or two sickly-looking tomatoes about the size of walnuts were raised, which gave Dr. Bell an opportunity to write that tomatoes grow and ripened in the open air at Moose! He also stated that barley grew and ripened well, whereas it ripened on an average one year in about five. With the same object he took the temperature of the waters of the bay whilst in a boat

close along the shore, where the sea was warmed by water from numerous rivers, which, being fresh and at a higher temperature than the sea, floated on the surface, and gave a temperature of about  $53^{\circ}$ , whereas the real sea water at a few miles from land is from  $15^{\circ}$  to  $20^{\circ}$  colder, as has been often proved. But Dr. Bell gave  $53^{\circ}$  as the temperature of the whole bay. Although Moose is about 15 miles south of Greenwich, ice may be seen as late as August or September about 20 or 30 miles from that place in the bay, which acts as a refrigerator to an immense extent of land, which otherwise would be comparatively fertile. There is not the slightest difficulty in navigating Hudson's Bay for five months in the year, nor in constructing a railway from Winnipeg to its shores. The total obstruction lies in the straits, and in the 50,000 square miles of heavy ice that forms yearly in Fox's Channel, the whole or greater part of which drifts down annually under various conditions and at uncertain times from the middle of July to September or perhaps October, into the west end of the strait, blocking it up, and also the entrance to Hudson's Bay.\* How could Commodore Markham, tell from his own small experience of eighteen or twenty days in July, nine of which were occupied by the *Alert* steaming 250 miles, during which one of the blades of the screw was broken by the ice, that the strait was navigable for five months or more? It would be satisfactory to know on whose information he relied, for he is repeating exactly what the promoters of the Hudson Bay route said two or three years ago. Are promoters' statements always to be relied upon?

Mr. W. SHELFORD said he had visited the salient points of the proposed Winnipeg and Hudson's Bay railway, and he had also sent out a surveying expedition to Hudson's Bay, which, during the winter, travelled over 1200 miles, and made a complete survey of the line, showing its practicability. The expedition returned in the spring of 1886, and brought back the remains of its baggage upon a sledge, which was exhibited with the dogs in the Colonial Exhibition. The dogs, after doing their faithful work, were killed and stuffed. The distance from Liverpool to Port Nelson was practically the same as to Montreal and New York. All the eastern part of Canada was well provided with railways and a magnificent inland navigation. Manitoba and the North-west Territory were not in the same favourable position. It was a most fertile prairie land, 900 miles in width, between Winnipeg and the Rocky Mountains. But that district was cut off from the rest of Canada by a sterile region between Winnipeg and Lake Superior, until the Canadian Pacific railway was made. The people in Manitoba and the North-west Territory had to look for a market for their corn, and they naturally looked to Great Britain. At the present low price of wheat it was impossible for them to sell it in England unless it could be transported cheaply, and it was a matter of notoriety that the cheapest way of transporting corn was by water. The Hudson's Bay railway would be but 300 miles in length. That would not reach to Winnipeg, but it would run over the region between Lake Winnipeg and Hudson's Bay, and then the inland navigation, which had been used for two centuries by the Hudson's Bay Company, would be available for the export of corn from Manitoba. All the investigations which had been made by the Canadian

\* The following are compiled from the ice records kept at two stations on the shore of the strait:—September and October 1884: ice heavy and close packed in strait, 27 days; ice heavy and a little water in strait, 23 days; foggy, 5 days; strong gales and snow, 5 days. Four months, June, July, August, and October 1885, three stations: ice heavy and close packed, 98 days; ice heavy and a little water seen, 54 days; foggy 6 days; dense fog, 1 day. Two months, June and July 1886, at three stations: ice heavy and close, 43 days; ice heavy and some water, 42 days; foggy, 5 days; strong gale or hurricanes, 2 days; strong gale with thick snow, 1 day.

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Government in the last three years, and all that Commodore Markham had said in the paper went to confirm what was written by a Committee of the Canadian Parliament in 1884:—"For more than 250 years sailors have counted upon having uninterrupted navigation of from two and a half, to three months, and this without modern charts, without an accurate knowledge of these waters, without lighthouses, without a system of telegraphic communication, and without the aid of steam."

Mr. C. S. DRUMMOND said that both Sir Charles Tupper and Mr. Sheford had stated one point which would probably dispose of the objection raised by Dr. Rae. It was not necessary at present to build a line 700 miles long. Some 275 miles would bring the inland waters in connection with Hudson's Bay. The capital for that would necessarily be small, and the short period that the navigation was open would be sufficient to enable the railway to earn interest on its bonds and dividends on its stock. He was disposed to think that the average of that period would be three months. He had carefully estimated the cost of a railway, and he was convinced that even two and a half months of open navigation would permit of its becoming a paying investment. He had had a great deal to do with Hudson's Bay officers, and he knew that their statements might always be taken without question. Still they were not infallible. They were liable to make mistakes like other persons. In 1880, at Winnipeg, the Chief Commissioner of the Company said to him, "You will never succeed, commercially, in growing wheat in Manitoba." Up to that time vast areas were covered with water until late in the summer, the result of the early June rains and the melting of the ice from the previous winter. However, the Government constructed drains, the water is carried off, and there is now no difficulty in growing the finest wheat in the world. On Lake Winnipeg this year a steamer was crushed, but in a few hours another steamer took its place, and the trade navigation was not interfered with.

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